

What is claimed is:

1. A method of recognizing an object character comprising:
  - capturing an image of the object character and storing the character image in a data storage device;
  - predefining a classification system in which each object character of a set of object characters is identifiable at least partially on the basis of a set of character feature types within a character image of the object character, the set of character feature types including (i) bars; (ii) lakes and (iii) bays;
  - providing feature extraction apparatus communicatively linked to the data storage device and programmed to (i) algorithmically scan a character image along each scan angle of a predetermined set of scan angles in order to extract character features ascertainable along that scan angle and (ii) assemble a feature vector corresponding to the character image, the feature vector including data indicative of at least the quantity of each character feature type present in the character image along each scan angle;
  - communicating the character image to the feature extraction apparatus and causing the feature extraction apparatus to assemble a feature vector corresponding to the character image;
  - providing character recognition apparatus adapted to recognize a character corresponding to an assembled feature vector at least partially on the basis of the quantity of each of (i) bars; (ii) lakes and (iii) bays indicated in the feature vector and to provide an output indicating the identity of the object character; and
  - rendering the assembled feature vector accessible to the character recognition apparatus for recognition of the corresponding character.

2. The method of claim 1 wherein the character recognition apparatus comprises a character dictionary and a comparator unit, the character dictionary containing a plurality of output character candidates, each output character candidate of the plurality of output character candidates having a corresponding standard profile defined in terms of a combination of standardized character features including at least one of (i) a bar, (ii) a lake and (iii) a bay and wherein the comparator unit is adapted to compare an assembled feature vector with standard profiles within the dictionary and identify as the recognized character the output character candidate corresponding to the standard profile that most closely resembles the assembled feature vector.
3. The method of claim 1 wherein the character recognition apparatus comprises a trainable neural network and the method further includes training the neural network to recognize variously configured versions of the same character by communicating to the neural network a plurality of variously configured feature vectors corresponding to variously configured character images and instructing the neural network as to the desired output character to be associated with the variously configured feature vectors.
4. The method of claim 1 wherein the feature extraction apparatus is further adapted to extract, and include in a feature vector, data relating to the spatial relationships a character feature has with other character features in the character image.
5. The method of claim 1 wherein the character image comprises character image pixels including character pixels and background pixels and the feature extraction apparatus is programmed to:
- (i) generate pixel-run representations of the character image from each

angle of a predetermined set of algorithmic scan angles;

- (ii) distinguish background pixels from character pixels within an overall character image including an image boundary;
- (iii) identify and extract specified types of connected regions of (a) character pixels and (b) background pixels, the specified types of connected regions of character pixels including bars comprising two or more laterally adjacent character pixel-runs of at least one character pixel each, the connected regions of background pixels including lakes and bays, wherein a lake comprises laterally adjacent runs of background pixels within a connected region of background pixels that does not touch the image boundary and a bay comprises a non-boundary-touching subset of background pixel-runs within a connected region of background pixels that does touch the image boundary; and
- (iv) generate direction-specific data concerning the extraction of bars, lakes and bays uniquely ascertainable from each of the predetermined algorithmic scan angles.

6. The character recognition method of claim 1 wherein the character image comprises character pixels within a field of background pixels and includes an image boundary comprised of edge pixels, and wherein:

- (i) a bar is a connected region of character pixels comprising two or more laterally adjacent character pixel-runs of at least one character pixel each;
- (ii) a lake comprises laterally adjacent runs of background pixels within a connected region of background pixels that does not touch the image boundary; and
- (iii) a bay comprises a non-boundary-touching subset of background pixel-runs within a connected region of background pixels that does touch

the image boundary.

7. A character recognition system comprising:

a data storage device;

image acquisition apparatus adapted to capture an image of an object character and store the character image in the data storage device;

feature extraction apparatus communicatively linked to the data storage device and adapted to receive the character image and (i) algorithmically scan the character image along each scan angle of a predetermined set of scan angles in order to extract character features including bars, lakes and bays ascertainable along that scan angle and (ii) assemble a feature vector corresponding to the character image, the feature vector including data indicative of the character feature types present in the character image along each scan angle; and

character recognition apparatus adapted to receive an assembled character feature vector from the feature extraction unit and recognize a character corresponding to the assembled feature vector at least partially on the basis of the quantity of each of (i) bars; (ii) lakes and (iii) bays indicated in the feature vector.

8. The character recognition system of claim 7 wherein the character image comprises character image pixels including character pixels and background pixels and the feature extraction apparatus is programmed to:

- (i) generate pixel-run representations of the character image from each angle of a predetermined set of algorithmic scan angles;
- (ii) distinguish background pixels from character pixels within an overall character image including an image boundary;
- (iii) identify and extract specified types of connected regions of (a) character

pixels and (b) background pixels, the specified types of connected regions of character pixels including bars comprising two or more laterally adjacent character pixel-runs of at least one character pixel each, the connected regions of background pixels including lakes and bays, wherein a lake comprises laterally adjacent runs of background pixels within a connected region of background pixels that does not touch the image boundary and a bay comprises a non-boundary-touching subset of background pixel-runs within a connected region of background pixels that does touch the image boundary; and

- (iv) generate direction-specific data concerning the extraction of bars, lakes and bays uniquely ascertainable from each of the predetermined algorithmic scan angles.

9. The character recognition system of claim 7 wherein the character recognition apparatus comprises a neural network trained to recognize variously configured versions of the same character by communicating to the neural network a plurality of variously configured feature vectors corresponding to variously configured character images and instructing the neural network as to the desired output character to be associated with the variously configured feature vectors.

10. The character recognition system of claim 8 wherein the character recognition apparatus comprises a neural network trained to recognize variously configured versions of the same character by communicating to the neural network a plurality of variously configured feature vectors corresponding to variously configured character images and instructing the neural network as to the desired output character to be associated with the variously configured feature vectors.

11. The character recognition system of claim 7 wherein the character recognition apparatus comprises a character dictionary and a comparator unit, the character dictionary containing a plurality of output character candidates, each output character candidate of the plurality of output character candidates having a corresponding standard profile defined in terms of a combination of standardized character features including at least one of (i) a bar, (ii) a lake and (iii) a bay and wherein the comparator unit is adapted to compare an assembled feature vector with standard profiles within the dictionary and identify as the recognized character the output character candidate corresponding to the standard profile that most closely resembles the assembled feature vector.

12. The character recognition system of claim 7 wherein the character image comprises character pixels within a field of background pixels and includes an image boundary comprised of edge pixels, and wherein:

- (i) a bar is a connected region of character pixels comprising two or more laterally adjacent character pixel-runs of at least one character pixel each;
- (ii) a lake comprises laterally adjacent runs of background pixels within a connected region of background pixels that does not touch the image boundary and
- (iii) a bay comprises a non-boundary-touching subset of background pixel-runs within a connected region of background pixels that does touch the image boundary.

13. A method of recognizing an unknown object character comprising:  
capturing an image of the object character and storing the character image in a data storage device, the character image comprising character pixels

within a field of background pixels, with the field of background pixels being bounded by an image edge comprised of edge pixels;

providing an image-scanning algorithm adapted to:

- (i) generate pixel-run representations of the character image from each angle of a predetermined set of algorithmic scan angles,
- (ii) distinguish background pixels from character pixels within an overall character image,
- (iii) identify and extract specified types of connected regions of (a) character pixels and (b) background pixels, the specified types of connected regions of character pixels including bars comprising two or more laterally adjacent character pixel-runs of at least one character pixel each, the connected regions of background pixels including lakes and bays, wherein a lake comprises laterally adjacent runs of background pixels within a connected region of background pixels that does not touch the image boundary and a bay comprises a non-boundary-touching subset of background pixel-runs within a connected region of background pixels that does touch the image boundary;
- (iv) generate direction-specific data concerning the extraction of bars, lakes and bays uniquely ascertainable from each of the predetermined algorithmic scan angles, and

rendering the character image accessible to the image-scanning algorithm and executing the algorithm to generate direction-specific extraction data;

assembling a character feature vector based on the direction-specific extraction data; and

communicating the assembled feature vector to character recognition apparatus adapted to recognize a character corresponding to an assembled feature vector at least partially on the basis of data relating to bars, lakes and bays indicated in the feature vector.

14. The method of claim 13 wherein the character recognition apparatus comprises a trainable neural network and the method further includes training the neural network to recognize variously configured versions of the same character by communicating to the neural network a plurality of variously configured feature vectors corresponding to variously configured character images and instructing the neural network as to the desired output character to be associated with the variously configured feature vectors.
15. The method of claim 13 wherein the data that the image-scanning algorithm is adapted to generate with respect to a character image includes at least one of:
- (i) the spatial relationships among bars, lakes and bays;
  - (ii) the quantity of each of bars, lakes and bays;
  - (iii) the pixel count of each bar, lake and bay;
  - (iv) the number of direction-specific pixel runs in each bar, lake and bay;
  - and
  - (v) the centroid of each bar, lake and bay.
16. The method of claim 13 wherein the feature vector comprises data structures assembled in accordance with a predetermined protocol.
17. The method of claim 13 wherein the character recognition apparatus comprises a character dictionary and a comparator unit, the character dictionary containing a plurality of output character candidates, each output character candidate of the plurality of output character candidates having a corresponding standard profile defined in terms of a combination of standardized character features including at least one of (i) a bar, (ii) a lake and (iii) a bay and wherein the comparator unit is adapted to compare an assembled feature vector with



standard profiles within the dictionary and identify as the recognized character the output character candidate corresponding to the standard profile that most closely resembles the assembled feature vector.

18. A method of recognizing an object character comprising:

capturing an image of the object character and storing the character image in a data storage device;

predefining a classification system in which each object character of a set of object characters is identifiable at least partially on the basis of a set of character feature types within a character image of the object character, the set of character feature types including at least one of (i) lakes and (ii) bays;

providing feature extraction apparatus communicatively linked to the data storage device and programmed to (i) algorithmically scan a character image along each scan angle of a predetermined set of scan angles in order to extract character features ascertainable along that scan angle and (ii) assemble a feature vector corresponding to the character image, the feature vector including data indicative of at least the quantity of each character feature type present in the character image along each scan angle;

communicating the character image to the feature extraction apparatus and causing the feature extraction apparatus to assemble a feature vector corresponding to the character image;

providing character recognition apparatus adapted to recognize a character corresponding to an assembled feature vector at least partially on the basis of the quantity of at least one of (i) lakes and (ii) bays indicated in the feature vector and to provide an output indicating the identity of the object character; and

rendering the assembled feature vector accessible to the character recognition apparatus for recognition of the corresponding character.

19. The character recognition method of claim 18 wherein the character image comprises character pixels within a field of background pixels and includes an image boundary comprised of edge pixels, and wherein:
- (i) a lake comprises laterally adjacent runs of background pixels within a connected region of background pixels that does not touch the image boundary; and
  - (ii) a bay comprises a non-boundary-touching subset of background pixel-runs within a connected region of background pixels that does touch the image boundary.